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ing' and that of Luther's 'justification by faith,' the profound interpretation of asceticism, etc. Of the work as a whole one may say that it is precisely its 'unsatisfactoriness,' the pregnancy of its paradox in leaving so many doors open and yet keeping so much science within, by which it serves us best. Coming when psychology has just reached the study of religion, it can hardly fail to deepen the whole of the research to which it brilliantly contributes. DICKINSON S. MILLER.

*Fishes and Fisheries of the Irish Sea:* W. A. HERDMAN and ROBERT A. DAWSON, London, George Philip & Son. 1902. 4to. Pp. 98.

This is the second memoir of the Lancashire Sea-Fisheries Committee, of which Professor Herdman is the honorary director of the scientific work and Mr. Dawson the fishery expert. It is the outgrowth of studies of fishes of the Irish Sea commenced many years ago by Herdman, in connection with the work of the Liverpool Marine Biology Committee. The systematic consideration of the fishes constitutes the major part of this report, but much collateral information adds to its value. In dedicating it to the members of the Lancashire and Western sea-fisheries joint committee, the authors express the hope that the work may fill a want as a guide to the fish and fisheries of the region, and that it may be of value to fishermen and others at home and to fishery authorities and scientific men abroad.

The physical features of the Irish Sea are briefly described under the head of area, depth, rivers and estuaries, temperature, specific gravity, tides and currents, and bottom deposits. This sea, which has an area of about 17,250 square miles, may be regarded as a landlocked body, for the connections with the North Sea (St. George Channel and North Channel) constitute only one tenth of the circumference. In this respect the Irish Sea is said to be unique, for no other sea of equal extent is so completely closed in by land belonging to one nation. "Consequently the Irish Sea seems peculiarly well fitted for those experiments in fisheries administration and cultivation which depend upon identical fisheries regulations."

In connection with the study of the sudden appearance and disappearance of swarms of copepods and medusæ, and the influence of the movements of such and other surface food materials on the migration of fishes, two thousand drift bottles were dropped into the sea at various places, and their behavior forms the basis of the chapter on tides and currents. The recovery of over forty-two per cent. of the bottles furnished data as to the combined effects of tides, currents, and prevailing winds on the distribution of small surface organisms. Considerable influence seems to be exerted by winds on the movements of fish ova, fish larvae, the fish food, and hence on the abundance of particular species in a given region. The two tidal streams which pour into this sea meet and neutralize each other, causing a zone of water, which extends from one shore to the other and in places is twenty miles wide, where no tidal currents exist, but only a rise and fall; twelve per cent. of the drift bottles were carried by winds from one tidal system to the other.

The nature of the bottom deposits is regarded as the most important of the various factors determining the distribution of animals over the sea-bottom, and this subject, therefore, receives special consideration; and, in connection with the chapter on the distribution of fishes, etc., constitutes the most interesting and important section of the memoir. Sample lists of all species of animals taken in dredge-hauls in different parts of the sea show how the physical conditions influence the abundance of animals as regards individuals and species and make it 'clear that whether it be a question of mere *mass* of life or *variety* of life, haul for haul, the shallow waters can hold their own against the deep sea, and form in all probability the most prolific zone of life on this globe.' This zone in the Irish Sea affords two very distinct types of abundance: the Welsh and Manx coasts are characterized by rocks and sea weeds, the Lancashire and Cheshire coasts by sand and mud; the shore waters of the former abound in species, those of the latter in individuals.

The fishes of the Irish Sea, of which a freely annotated list is given, comprise 141

species; 15 of these are regarded as accidental or occasional stragglers from the ocean, 85 are small inedible species, and 41 are marketable forms. Of the last named, the most numerous and commercially important family are the Pleuronectidæ, 18 species being recorded and noted in detail.

The constitution and work of the sea-fisheries committees are referred to at length. These committees are analogous to the State fish commissions of the United States, but their organization and methods are very different. They are all subordinate to the national Board of Trade, but are vested with large powers in matters of legislation, regulation and investigation; and their work has a number of features that our local fish commissions could consider to advantage. The entire absence of artificial propagation of fishes and other animals is in strong contrast with other countries. Two appendices contain a full draft of the by-laws proposed for the Lancashire and Western sea-fisheries district, and a detailed statement of the results of experimental dredge-hauls, fishing trials, etc. The gathering of shrimps, one of the leading fishery industries of the Irish Sea, is shown to have a remarkable influence on the abundance of fishes and is one of the subjects in dealing with which the services of the biologist have proved most useful. From numerous test trials, it has been demonstrated that shrimping on certain grounds at certain times is enormously destructive to immature fish, as many as 10,000 undersized fish sometimes being killed in taking one quart of shrimp, and the average destruction per quart is said to be 1,000 fish, chiefly pleuronectids.

This memoir constitutes an admirable model for future investigations and reports of its kind. As an example of the harmonious combination of the scientific and the economic, the work will be welcomed by all persons interested in the preservation of one of the most valuable resources of the world. The most useful purpose the work ought to subserve, however, aside from its local application, is the demonstration (1) of the many diverse considerations underlying the regulation and administration of the fisheries, (2) of the neces-

sity for scientific methods in the proper study of economic problems, and (3) of the futility of radical legislation affecting the fisheries without competent biologic investigation. Many fishery laws which have suppressed or seriously disturbed established industries would never have been enacted had the facts been known; and, on the other hand, some languishing fisheries would be improved and failing resources replenished if legislators would heed the results of scientific investigation.

H. M. SMITH.

*Studies from the Chemical Laboratory of the Sheffield Scientific School.* Edited by HORACE L. WELLS. Vol. I., pp. xi+444; Vol. II., pp. ix+379. New York, Charles Scribner's Sons. 1901.

These volumes appear among the Yale Bicentennial Publications, issued 'as a partial indication of the character of the studies in which the university teachers are engaged.' They furnish a continuous record of recent progressive studies bearing directly upon questions of prime importance at the present time. Certainly they constitute a body of contributions to knowledge highly honorable to the university they represent.

Volume I. opens with a very brief historical account of the Sheffield Laboratory from the beginning, then presents a bibliography of the research publications of the present instructors of the laboratory, and gives in 427 pages the papers of the last ten years on 'General Inorganic Chemistry' and on 'Double Halogen Salts.' Volume II. gives in 371 pages the papers of ten years upon 'Organic Chemistry.'

Well known to chemical readers as these papers have been, there is now much advantage in having them all together in the order in which the investigations have developed. The chemists of the Sheffield Laboratory are to be congratulated upon the prevailing unity and continuity of their labors, extending through so eventful a decade.

The twenty-seven papers upon 'Double Halogen Salts' appeared from 1892 to 1901. Of all the known double halides classified by Professor Wells it is stated that about one third have been prepared in the Sheffield Labo-